SEQUENCE LISTING

<110> Thonnard, Joelle

<120> BASB006 Polypeptides from Neisseria
      Meningitidis and Immunogenic Compositions Thereof

<130> BM35308-D1

<150> 09/673,896
<151> 2000-12-18

<150> PCT/EP99/02766
<151> 1999-04-20

<150> GB 9808866.9
<151> 1998-04-24

<160> 6

<170> FastSEQ for Windows Version 4.0

<210> 1
<211> 4365
<212> DNA
<213> Bacteria

<400> 1
atgaaaacaa ccgacaaacg gacaaccgaa acacaccgca aagccccgaa aaccggtcgc   60
atccgcttct cgcctgctta cttagccata tgcctgtcgt tcggcattct tccccaagcc   120
tgggcgggac acacttattt cggcatcaac taccaatact atcgcgactt tgccgaaaat   180
aaaggcaagt ttgcagtcgg ggcgaaagat attgaggttt acaacaaaaa aggggagttg   240
gtcggcaaat caatgacaaa agccccgatg attgattttt ctgtggtgtc gcgtaacggc   300
gtggcggcat ggtgggcga tcaatatatt gtgagcgtgg cacataacgg cggctataac   360
aacgttgatt ttggtgcgga gggaagcaat cccgatcagc accgtttttc ttatcaaatt   420
gtgaaaagaa ataattataa agcagggact aacggtcatc cttatggtgg cgattatcat   480
atgccgcgtt tacataaatt tgtaaccgat gcagaacctg ttgaaatgac cagttatatg   540
gatgggcgga aatatatcga tcaaaataat taccctgacc gtgttcgtat tggggcaggc   600
aggcaatatt ggcgatctga tgaagatgag cccaataacc gcgaaagttc atatcatatt   660
gcaagtgcgt attcttggct cgttggtggc aataccttg cacaaaatgg atcaggtggt   720
ggcacagtca acttaggtag tgaaaaaatt aaacatagcc catatggttt tttaccaaca   780
ggaggctcat ttggcgacag tggctcacca atgtttatct atgatgccca aaagcaaaag   840
tggttaatta atggggtatt gcaaacgggc aacccctata taggaaaaag caatggcttc   900
cagctggttc gtaaagattg gttctatgat gaaatctttg ctggagatac ccattcagta   960
ttctacgaac cacatcaaaa tgggaaatac acttttcacg acaataataa tggcacagga   1020
aaaatcaatg ccaaacatga acacaattct ctgcctaata gattaaaaac acgaaccgtt   1080
caattgttta atgtttcttt atccgagaca gcaagagaac ctgtttatca tgctgcaggt   1140
ggtgtcaaca gttatcgacc cagactgaat aatggagaaa atatttcctt tattgacgaa   1200
ggaaaaggcg aattgatact taccagcaac atcaatcaag gtgctggagg attatatttc   1260
caaggagatt ttacggtctc gcctgaaaat aacgaaacgt ggcaaggtgc gggcgttcat   1320
atcagtgaag acagtaccgt tacttggaaa gtaaacggcg tggcaaacga ccgcctgtcc   1380
aaaatcggca aaggcacgct gcacgttcaa gccaaagggg aaaaccaagg ctcgatcagc   1440
gtgggcgacg gtaaagttat tttagatcaa caagcagatg aaaataataa aaaacaagcc   1500

- 1 -

```
tttagtgaaa tcggcttggt cagcggcagg ggtacggtgc aactgaatgc cgataatcag      1560
ttcaaccccg acaaactcta tttcggcttt cgcggcggac gtttggattt gaacgggcat      1620
tcgctttcgt tccaccgtat tcaaaatacc gatgaagggg cgatgattgt caaccacaat      1680
caagacaaag aatccaccgt taccattaca ggcaataaag atattgctac aaccggcaat      1740
aacaacagct tggatagcaa aaaagaaatt gcctacaacg gttggtttgg cgagaaagat      1800
acgaccaaaa cgaacgggcg gctcaacctt gtttaccagc ccgccgcaga agaccgcacc      1860
ctgctgcttt ccggcggaac aaatttaaac ggtaacatca cgcaaacaaa cggcaaactg      1920
tttttcagcg gcagaccgac accgcacgcc tacaatcatt taggaagcgg gtggtcaaaa      1980
atggaaggta tcccacaagg agaaatcgtg tgggacaacg actggatcaa ccgcacgttt      2040
aaagcggaaa atttccatat tcagggcggg caggcggtga tttcccgcaa tgttgccaaa      2100
gtggaaggcg attggcattt gagcaatcac gcccaagcag tttttggtgt cgcaccgcat      2160
caaagccaca caatctgtac acgttcggac tggacgggtc tgacaaattg tgtcgaaaaa      2220
accattaccg acgataaagt gattgcttca ttgactaaga ccgacatcag cggcaatgtc      2280
agccttgccg atcacgctca tttaaatctc acagggcttg ccacactcaa cggcaatctt      2340
agtgcaaatg gcgatacacg ttatacagtc agccacaacg ccacccaaaa cggcgacctt      2400
agcctcgtgg gcaatgccca agcaacattt aatcaagcca cattaaacgg caacacatcg      2460
gcttcgggca atgcttcatt taatctaagc aacaacgccg tacaaaacgg cagtctgacg      2520
ctttccggca cgctaaggc aaacgtaagc cattccgcac tcaacggtaa tgtctcccta      2580
gccgataagg cagtattcca ttttgaaagc agccgcttta ccggacaaat cagcggcagc      2640
aaggatacgg cattacactt aaaagacagc gaatggacgc tgccgtcagg cacggaatta      2700
ggcaatttaa accttgacaa cgccaccatt acactcaatt ccgcctatcg ccacgatgcg      2760
gcaggggcgc aaaccggcag tgcgacagat gcgccgcgcc gccgttcgcg ccgttcccta      2820
ttatccgtta cacctccggc ttcggcagaa tcccatttca acacgctgac ggtaaacggc      2880
aaattgaacg gtcagggaac attccgcttt atgtcggaac tcttcggcta ccgaagcgac      2940
aaattgaagc tggcggaaag ttccgaaggc acttacacct tggcggtcaa caataccggc      3000
aacgaacccg taagcctcga tcaattgacg gtagtggaag ggaaagacaa caaaccgctg      3060
tccgaaaacc ttaatttcac cctgcaaaac gaacacgtcg atgccggcgc gtggcgttac      3120
caactcatcc gcaaagacgg cgagttccgc ctgcataatc cggtcaaaga acaagagctt      3180
tccgacaaac tcggcaaggc agaagccaaa aaacaggcgg gaaaagacaa cgcgcaaagc      3240
cttgacgcgc tgattgcggc cgggcgcgat gccgtcgaaa agacagaaag cgttgccgaa      3300
ccggcccggc aggcaggcgg ggaaaatgtc ggcattatgc aggcggagga agagaaaaaa      3360
cgggtgcagg cggataaaga caccgccttg gcgaaacagc gcgaagggaa aacccggccg      3420
gctaccaccg ccttcccccg cgcccgccgc gcccgccggg atttgccgca accgcagccc      3480
caaccgcaac cccaaccgca gcgcgacctg atcagccgtt atgccaatag cggtttgagt      3540
gaattttccg ccacgctcaa cagcgttttc gccgtacagg acgaattaga ccgcgtattt      3600
gccgaagacc gccgcaacgc cgtttggaca agcggcatcc gggacaccaa acactaccgt      3660
tcgcaagatt ccgcgcccta ccgccaacaa accgacctgc gccaaatcgg tatgcagaaa      3720
aacctcggca gcgggcgcgt cggcatcctg ttttcgcaca accggaccga aaacaccttc      3780
gacgacggca tcggcaactc ggcacggctt gcccacggcg ccgtttctcg gcaatacggc      3840
atcggcaggt tcgacatcgg catcagcacg ggcgcgggtt ttagcagcgg cagtctttca      3900
gacgacatcg gaagcaaaat ccgccgccgc gtgctgcatt acggcattca ggcacgatac      3960
cgcgccggtt tcggcggatt cggcatcgaa ccgcacatcg gcgcaacgcg ctatttcgtc      4020
caaaaagcgg attaccgcta cgaaaacgtc aatatcgcca cccccggcct tgcgttcaac      4080
cgctaccgcg cgggcattaa ggcagattat tcattcaaac cggcgcaaca catttccatc      4140
acgccttatt tgagcctgtc ctataccgat gccgcttcgg caaagtccg aacgcgcgtc      4200
aataccgccg tattggctca ggatttcggc aaaacccgca gtgcggaatg gggcgtaaac      4260
gccgaaatca aaggtttcac gctgtccctc cacgctgccg ccgccaaagg cccgcaactg      4320
gaagcgcaac acagcgcggg catcaaatta ggctaccgct ggtaa                     4365
```

<210> 2
<211> 1454
<212> PRT
<213> Bacteria

<400> 2
```

```
Met Lys Thr Thr Asp Lys Arg Thr Thr Glu Thr His Arg Lys Ala Pro
 1               5                  10               15
Lys Thr Gly Arg Ile Arg Phe Ser Pro Ala Tyr Leu Ala Ile Cys Leu
         20              25                  30
Ser Phe Gly Ile Leu Pro Gln Ala Trp Ala Gly His Thr Tyr Phe Gly
         35              40                  45
Ile Asn Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe
    50              55                  60
Ala Val Gly Ala Lys Asp Ile Glu Val Tyr Asn Lys Lys Gly Glu Leu
65              70                  75                  80
Val Gly Lys Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val
             85                  90                  95
Ser Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser
             100             105             110
Val Ala His Asn Gly Gly Tyr Asn Asn Val Asp Phe Gly Ala Glu Gly
         115             120             125
Ser Asn Pro Asp Gln His Arg Phe Ser Tyr Gln Ile Val Lys Arg Asn
    130             135             140
Asn Tyr Lys Ala Gly Thr Asn Gly His Pro Tyr Gly Gly Asp Tyr His
145             150             155             160
Met Pro Arg Leu His Lys Phe Val Thr Asp Ala Glu Pro Val Glu Met
             165             170             175
Thr Ser Tyr Met Asp Gly Arg Lys Tyr Ile Asp Gln Asn Asn Tyr Pro
         180             185             190
Asp Arg Val Arg Ile Gly Ala Gly Arg Gln Tyr Trp Arg Ser Asp Glu
         195             200             205
Asp Glu Pro Asn Asn Arg Glu Ser Ser Tyr His Ile Ala Ser Ala Tyr
    210             215             220
Ser Trp Leu Val Gly Gly Asn Thr Phe Ala Gln Asn Gly Ser Gly Gly
225             230             235             240
Gly Thr Val Asn Leu Gly Ser Glu Lys Ile Lys His Ser Pro Tyr Gly
             245             250             255
Phe Leu Pro Thr Gly Gly Ser Phe Gly Asp Ser Gly Ser Pro Met Phe
             260             265             270
Ile Tyr Asp Ala Gln Lys Gln Lys Trp Leu Ile Asn Gly Val Leu Gln
         275             280             285
Thr Gly Asn Pro Tyr Ile Gly Lys Ser Asn Gly Phe Gln Leu Val Arg
    290             295             300
Lys Asp Trp Phe Tyr Asp Glu Ile Phe Ala Gly Asp Thr His Ser Val
305             310             315             320
Phe Tyr Glu Pro His Gln Asn Gly Lys Tyr Thr Phe His Asp Asn Asn
             325             330             335
Asn Gly Thr Gly Lys Ile Asn Ala Lys His Glu His Asn Ser Leu Pro
         340             345             350
Asn Arg Leu Lys Thr Arg Thr Val Gln Leu Phe Asn Val Ser Leu Ser
         355             360             365
Glu Thr Ala Arg Glu Pro Val Tyr His Ala Ala Gly Gly Val Asn Ser
    370             375             380
Tyr Arg Pro Arg Leu Asn Asn Gly Glu Asn Ile Ser Phe Ile Asp Glu
385             390             395             400
Gly Lys Gly Glu Leu Ile Leu Thr Ser Asn Ile Asn Gln Gly Ala Gly
             405             410             415
Gly Leu Tyr Phe Gln Gly Asp Phe Thr Val Ser Pro Glu Asn Asn Glu
             420             425             430
Thr Trp Gln Gly Ala Gly Val His Ile Ser Glu Asp Ser Thr Val Thr
```

```
            435                    440                    445
Trp Lys Val Asn Gly Val Ala Asn Asp Arg Leu Ser Lys Ile Gly Lys
    450                    455                    460
Gly Thr Leu His Val Gln Ala Lys Gly Glu Asn Gln Gly Ser Ile Ser
465                    470                    475                    480
Val Gly Asp Gly Lys Val Ile Leu Asp Gln Gln Ala Asp Glu Asn Asn
                485                    490                    495
Lys Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg Gly Thr
            500                    505                    510
Val Gln Leu Asn Ala Asp Asn Gln Phe Asn Pro Asp Lys Leu Tyr Phe
        515                    520                    525
Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Ser Phe
    530                    535                    540
His Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn
545                    550                    555                    560
Gln Asp Lys Glu Ser Thr Val Thr Ile Thr Gly Asn Lys Asp Ile Ala
                565                    570                    575
Thr Thr Gly Asn Asn Asn Ser Leu Asp Ser Lys Lys Glu Ile Ala Tyr
            580                    585                    590
Asn Gly Trp Phe Gly Glu Lys Asp Thr Thr Lys Thr Asn Gly Arg Leu
        595                    600                    605
Asn Leu Val Tyr Gln Pro Ala Ala Glu Asp Arg Thr Leu Leu Leu Ser
    610                    615                    620
Gly Gly Thr Asn Leu Asn Gly Asn Ile Thr Gln Thr Asn Gly Lys Leu
625                    630                    635                    640
Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Gly Ser
                645                    650                    655
Gly Trp Ser Lys Met Glu Gly Ile Pro Gln Gly Glu Ile Val Trp Asp
            660                    665                    670
Asn Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe His Ile Gln
        675                    680                    685
Gly Gly Gln Ala Val Ile Ser Arg Asn Val Ala Lys Val Glu Gly Asp
    690                    695                    700
Trp His Leu Ser Asn His Ala Gln Ala Val Phe Gly Val Ala Pro His
705                    710                    715                    720
Gln Ser His Thr Ile Cys Thr Arg Ser Asp Trp Thr Gly Leu Thr Asn
                725                    730                    735
Cys Val Glu Lys Thr Ile Thr Asp Asp Lys Val Ile Ala Ser Leu Thr
            740                    745                    750
Lys Thr Asp Ile Ser Gly Asn Val Ser Leu Ala Asp His Ala His Leu
        755                    760                    765
Asn Leu Thr Gly Leu Ala Thr Leu Asn Gly Asn Leu Ser Ala Asn Gly
    770                    775                    780
Asp Thr Arg Tyr Thr Val Ser His Asn Ala Thr Gln Asn Gly Asp Leu
785                    790                    795                    800
Ser Leu Val Gly Asn Ala Gln Ala Thr Phe Asn Gln Ala Thr Leu Asn
                805                    810                    815
Gly Asn Thr Ser Ala Ser Gly Asn Ala Ser Phe Asn Leu Ser Asn Asn
            820                    825                    830
Ala Val Gln Asn Gly Ser Leu Thr Leu Ser Gly Asn Ala Lys Ala Asn
        835                    840                    845
Val Ser His Ser Ala Leu Asn Gly Asn Val Ser Leu Ala Asp Lys Ala
    850                    855                    860
Val Phe His Phe Glu Ser Ser Arg Phe Thr Gly Gln Ile Ser Gly Ser
865                    870                    875                    880
```

- 4 -

Lys Asp Thr Ala Leu His Leu Lys Asp Ser Glu Trp Thr Leu Pro Ser
                885   890   895
Gly Thr Glu Leu Gly Asn Leu Asn Leu Asp Asn Ala Thr Ile Thr Leu
                900   905   910
Asn Ser Ala Tyr Arg His Asp Ala Ala Gly Ala Gln Thr Gly Ser Ala
                915   920   925
Thr Asp Ala Pro Arg Arg Arg Ser Arg Arg Ser Leu Leu Ser Val Thr
                930   935   940
Pro Pro Ala Ser Ala Glu Ser His Phe Asn Thr Leu Thr Val Asn Gly
945   950   955   960
Lys Leu Asn Gly Gln Gly Thr Phe Arg Phe Met Ser Glu Leu Phe Gly
                965   970   975
Tyr Arg Ser Asp Lys Leu Lys Leu Ala Glu Ser Ser Glu Gly Thr Tyr
                980   985   990
Thr Leu Ala Val Asn Asn Thr Gly Asn Glu Pro Val Ser Leu Asp Gln
                995   1000   1005
Leu Thr Val Val Glu Gly Lys Asp Asn Lys Pro Leu Ser Glu Asn Leu
                1010   1015   1020
Asn Phe Thr Leu Gln Asn Glu His Val Asp Ala Gly Ala Trp Arg Tyr
1025   1030   1035   1040
Gln Leu Ile Arg Lys Asp Gly Glu Phe Arg Leu His Asn Pro Val Lys
                1045   1050   1055
Glu Gln Glu Leu Ser Asp Lys Leu Gly Lys Ala Glu Ala Lys Lys Gln
                1060   1065   1070
Ala Gly Lys Asp Asn Ala Gln Ser Leu Asp Ala Leu Ile Ala Ala Gly
                1075   1080   1085
Arg Asp Ala Val Glu Lys Thr Glu Ser Val Ala Glu Pro Ala Arg Gln
                1090   1095   1100
Ala Gly Gly Glu Asn Val Gly Ile Met Gln Ala Glu Glu Glu Lys Lys
1105   1110   1115   1120
Arg Val Gln Ala Asp Lys Asp Thr Ala Leu Ala Lys Gln Arg Glu Gly
                1125   1130   1135
Lys Thr Arg Pro Ala Thr Thr Ala Phe Pro Arg Ala Arg Arg Ala Arg
                1140   1145   1150
Arg Asp Leu Pro Gln Pro Gln Pro Gln Pro Gln Pro Gln Pro Gln Arg
                1155   1160   1165
Asp Leu Ile Ser Arg Tyr Ala Asn Ser Gly Leu Ser Glu Phe Ser Ala
                1170   1175   1180
Thr Leu Asn Ser Val Phe Ala Val Gln Asp Glu Leu Asp Arg Val Phe
1185   1190   1195   1200
Ala Glu Asp Arg Arg Asn Ala Val Trp Thr Ser Gly Ile Arg Asp Thr
                1205   1210   1215
Lys His Tyr Arg Ser Gln Asp Phe Arg Ala Tyr Arg Gln Gln Thr Asp
                1220   1225   1230
Leu Arg Gln Ile Gly Met Gln Lys Asn Leu Gly Ser Gly Arg Val Gly
                1235   1240   1245
Ile Leu Phe Ser His Asn Arg Thr Glu Asn Thr Phe Asp Asp Gly Ile
                1250   1255   1260
Gly Asn Ser Ala Arg Leu Ala His Gly Ala Val Phe Gly Gln Tyr Gly
1265   1270   1275   1280
Ile Gly Arg Phe Asp Ile Gly Ile Ser Thr Gly Ala Gly Phe Ser Ser
                1285   1290   1295
Gly Ser Leu Ser Asp Asp Ile Gly Ser Lys Ile Arg Arg Arg Val Leu
                1300   1305   1310
His Tyr Gly Ile Gln Ala Arg Tyr Arg Ala Gly Phe Gly Gly Phe Gly

```
        1315                1320                1325
Ile Glu Pro His Ile Gly Ala Thr Arg Tyr Phe Val Gln Lys Ala Asp
    1330                1335                1340
Tyr Arg Tyr Glu Asn Val Asn Ile Ala Thr Pro Gly Leu Ala Phe Asn
1345                1350                1355                1360
Arg Tyr Arg Ala Gly Ile Lys Ala Asp Tyr Ser Phe Lys Pro Ala Gln
            1365                1370                1375
His Ile Ser Ile Thr Pro Tyr Leu Ser Leu Ser Tyr Thr Asp Ala Ala
        1380                1385                1390
Ser Gly Lys Val Arg Thr Arg Val Asn Thr Ala Val Leu Ala Gln Asp
        1395                1400                1405
Phe Gly Lys Thr Arg Ser Ala Glu Trp Gly Val Asn Ala Glu Ile Lys
    1410                1415                1420
Gly Phe Thr Leu Ser Leu His Ala Ala Ala Ala Lys Gly Pro Gln Leu
1425                1430                1435                1440
Glu Ala Gln His Ser Ala Gly Ile Lys Leu Gly Tyr Arg Trp
            1445                1450


<210> 3
<211> 4374
<212> DNA
<213> Bacteria

<400> 3
atgaaaacaa ccgacaaacg gacaaccgaa acacaccgca aagccccgaa aaccggccgc      60
atccgcttct cgcctgctta cttagccata tgcctgtcgt tcggcattct tccccaagcc     120
tgggcgggac acacttattt cggcatcaac taccaatact atcgcgactt tgccgaaaat     180
aaaggcaagt ttgcagtcgg ggcgaaagat attgaggttt acaacaaaaa aggggagttg     240
gtcggcaaat caatgacaaa agccccgatg attgattttt ctgtggtgtc gcgtaacggc     300
gtggcggcat ggtgggcga tcaatatatt gtgagcgtgg cacataacgg cggctataac     360
aacgttgatt ttggtgcgga aggaagaaat cccgatcaac atcgttttac ttataaaatt     420
gtgaaacgga ataattataa agcagggact aaaggccatc cttatggtgg cgattatcat     480
atgccgcgtt tacataaatt tgtcacagat gcagaacctg ttgaaatgac cagttatatg     540
gatgggcgga aatatatcga tcaaaataat taccctgacc gtgttcgtat ggggcaggc      600
aggcaatatt ggcgatctga tgaagatgag cccaataacc gcgaaagttc atatcatatt     660
gcaagtgcgt attcttggct cgttggtggc aatacctttg cacaaaatgg atcaggtggt     720
ggcacagtca acttaggtag tgaaaaaatt aaacatagcc catatggttt tttaccaaca     780
ggaggctcat ttggcgacag tggctcacca atgtttatct atgatgccca aaagcaaaag     840
tggttaatta atggggtatt gcaaacgggc aaccctata taggaaaaag caatggcttc      900
cagctggttc gtaaagattg gttctatgat gaaatctttg ctggagatac ccattcagta     960
ttctacgaac cacgtcaaaa tgggaaatac tcttttaacg acgataataa tggcacagga    1020
aaaatcaatg ccaaacatga acacaattct ctgcctaata gattaaaaac acgaaccgtt    1080
caattgttta atgtttcttt atccgagaca gcaagagaac ctgtttatca tgctgcaggt    1140
ggtgtcaaca gttatcgacc cagactgaat aatggagaaa atatttcctt tattgacgaa    1200
ggaaaaggcg aattgatact taccagcaac atcaatcaag gtgctggagg attatatttc    1260
caaggagatt ttacggtctc gcctgaaaat aacgaaacgt ggcaaggtgc gggcgttcat    1320
atcagtgaag acagtaccgt tacttggaaa gtaaacggcg tggcaaacga ccgcctgtcc    1380
aaaatcggca aaggcacgct gcacgttcaa gccaaagggg aaaaccaagg ctcgatcagc    1440
gtgggcgacg gtacagtcat tttggatcag caggcagacg ataaaggcaa aaaacaagcc    1500
tttagtgaaa tcggcttggt cagcggcagg ggtacggtgc aactgaatgc cgataatcag    1560
ttcaacccog acaaactcta tttcggcttt cgcggcggac gtttggattt aaacgggcat    1620
tcgctttcgt tccaccgtat tcaaaatacc gatgaagggg cgatgattgt caaccacaat    1680
caagacaaag aatccaccgt taccattaca ggcaataaag atattgctac aaccggcaat    1740
aacaacagct ggatagcaa aaaagaaatt gcctacaacg gttggtttgg cgagaaagat    1800
acgaccaaaa cgaacgggcg gctcaacctt gtttaccagc ccgccgcaga agaccgcacc    1860
```

```
ctgctgcttt ccggcggaac aaatttaaac ggcaacatca cgcaaacaaa cggcaaactg      1920
ttttttcagcg gcagaccaac accgcacgcc tacaatcatt taaacgacca ttggtcgcaa      1980
aaagagggca ttccacgcgg ggaaatcgtg tgggacaacg actggatcaa ccgcacattt      2040
aaagcggaaa acttccaaat taaaggcgga caggcggtgg tttcccgcaa tgttgccaaa      2100
gtgaaaggcg attggcattt gagcaatcac gcccaagcag tttttggtgt cgcaccgcat      2160
caaagccaca caatctgtac acgttcggac tggacgggtc tgacaaattg tgtcgaaaaa      2220
accattaccg acgataaagt gattgcttca ttgactaaga ccgacatcag cggcaatgtc      2280
gatcttgccg atcacgctca tttaaatctc acagggcttg ccacactcaa cggcaatctt      2340
agtgcaaatg gcgatacacg ttatacagtc agccacaacg ccacccaaaa cggcaacctt      2400
agcctcgtgg gcaatgccca agcaacattt aatcaagcca cattaaacgg caacacatcg      2460
gcttcgggca atgcttcatt taatctaagc gaccacgccg tacaaaacgg cagtctgacg      2520
ctttccggca acgctaaggc aaacgtaagc cattccgcac tcaacggtaa tgtctcccta      2580
gccgataagg cagtattcca ttttgaaagc agccgcttta ccggacaaat cagcggcggc      2640
aaggatacgg cattacactt aaaagacagc gaatggacgc tgccgtcagg cacggaatta      2700
ggcaatttaa accttgacaa cgccaccatt acactcaatt ccgcctatcg ccacgatgcg      2760
gcaggggcgc aaaccggcag tgcgacagat gcgccgcgcc gccgttcgcg ccgttcgcgc      2820
cgttccctat tatccgttac accgccaact tcggtagaat cccgtttcaa cacgctgacg      2880
gtaaacggca aattgaacgg tcagggaaca ttccgcttta tgtcggaact cttcggctac      2940
cgcagcgaca aattgaagct ggcggaaagt tccgaaggca cttacacctt ggcggtcaac      3000
aataccggca cgaacctgc aagccttgaa caattgacgg tagtggaagg aaaagacaac      3060
aaaccgctgt ccgaaaactt taatttcacc ttgcaaaacg aacacgtcga tgccggcgcg      3120
tggcgttacc aactcatccg caaagacggc gagttccgcc tgcataatcc ggtcaaagaa      3180
caagagcttt ccgacaaact cggcaaggca gaagccaaaa aacaggcgga aaaagacaac      3240
gcgcaaagcc ttgacgcgct gattgcggcc gggcgcgatg ccgtcgaaaa gacagaaagc      3300
gttgccgaac cggcccggca ggcaggcggg gaaaatgtcg gcattatgca ggcggaggaa      3360
gagaaaaaac gggtgcaggc ggataaagac accgccttgg cgaaacagcg cgaagcggaa      3420
acccggccgg ctaccaccgc cttccccgc gcccgccgcg cccgccggga tttgccgcaa      3480
ctgcaacccc aaccgcagcc ccaaccgcag cgcgacctga tcagccgtta tgccaatagc      3540
ggtttgagtg aattttccgc cacgctcaac agcgttttcg ccgtacagga cgaattagac      3600
cgcgtatttg ccgaagaacg ccgcaacgcc gtttggacaa gcggcatccg ggacaccaaa      3660
cactaccgtt cgcaagattt ccgcgcctac cgccaacaaa ccgacctgcg ccaaatcggt      3720
atgcagaaaa acctcggcag cgggcgcgtc ggcatcctgt tttcgcacaa ccggaccgaa      3780
aacaccttcg acgacggcat cggcaactcg gcacggcttg cccacggcgc cgttttcggg      3840
caatacggca tcgacaggtt ctacatcggc atcagcgcgg gcgcgggttt tagcagcggc      3900
agcctttcag acggcatcgg aggcaaaatc cgccgccgcg tgctgcatta cggcattcag      3960
gcacgatacc gcgccggttt cggcggattc ggcatcgaac cgcacatcgg cgcaacgcgc      4020
tatttcgtcc aaaaagcgga ttaccgctac gaaaacgtca atatcgccac ccccggcctt      4080
gcattcaacc gctaccgcgc gggcattaag gcagattatt cattcaaacc ggcgcaacac      4140
atttccatca cgccttattt gagcctgtcc tataccgatg ccgcttcggg caaagtccga      4200
acacgcgtca ataccgccgt attggctcag gatttcggca aaacccgcag tgcggaatgg      4260
ggcgtaaacg ccgaaatcaa aggcttcacg ctgtccctcc acgctgccgc cgccaaaggc      4320
ccgcaactgg aagcgcaaca cagcgcgggc atcaaattag ctaccgctg gtaa            4374
```

<210> 4
<211> 1457
<212> PRT
<213> Bacteria

<400> 4
```
Met Lys Thr Thr Asp Lys Arg Thr Thr Glu Thr His Arg Lys Ala Pro
1               5                   10                  15
Lys Thr Gly Arg Ile Arg Phe Ser Pro Ala Tyr Leu Ala Ile Cys Leu
            20                  25                  30
Ser Phe Gly Ile Leu Pro Gln Ala Trp Ala Gly His Thr Tyr Phe Gly
        35                  40                  45
```

```
Ile Asn Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe
    50                  55                  60
Ala Val Gly Ala Lys Asp Ile Glu Val Tyr Asn Lys Lys Gly Glu Leu
65                  70                  75                  80
Val Gly Lys Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val
                85                  90                  95
Ser Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser
            100                 105                 110
Val Ala His Asn Gly Gly Tyr Asn Asn Val Asp Phe Gly Ala Glu Gly
            115                 120                 125
Arg Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn
    130                 135                 140
Asn Tyr Lys Ala Gly Thr Lys Gly His Pro Tyr Gly Gly Asp Tyr His
145                 150                 155                 160
Met Pro Arg Leu His Lys Phe Val Thr Asp Ala Glu Pro Val Glu Met
                165                 170                 175
Thr Ser Tyr Met Asp Gly Arg Lys Tyr Ile Asp Gln Asn Asn Tyr Pro
            180                 185                 190
Asp Arg Val Arg Ile Gly Ala Gly Arg Gln Tyr Trp Arg Ser Asp Glu
            195                 200                 205
Asp Glu Pro Asn Asn Arg Glu Ser Ser Tyr His Ile Ala Ser Ala Tyr
    210                 215                 220
Ser Trp Leu Val Gly Gly Asn Thr Phe Ala Gln Asn Gly Ser Gly Gly
225                 230                 235                 240
Gly Thr Val Asn Leu Gly Ser Glu Lys Ile Lys His Ser Pro Tyr Gly
                245                 250                 255
Phe Leu Pro Thr Gly Gly Ser Phe Gly Asp Ser Gly Ser Pro Met Phe
            260                 265                 270
Ile Tyr Asp Ala Gln Lys Gln Lys Trp Leu Ile Asn Gly Val Leu Gln
            275                 280                 285
Thr Gly Asn Pro Tyr Ile Gly Lys Ser Asn Gly Phe Gln Leu Val Arg
    290                 295                 300
Lys Asp Trp Phe Tyr Asp Glu Ile Phe Ala Gly Asp Thr His Ser Val
305                 310                 315                 320
Phe Tyr Glu Pro Arg Gln Asn Gly Lys Tyr Ser Phe Asn Asp Asp Asn
                325                 330                 335
Asn Gly Thr Gly Lys Ile Asn Ala Lys His Glu His Asn Ser Leu Pro
            340                 345                 350
Asn Arg Leu Lys Thr Arg Thr Val Gln Leu Phe Asn Val Ser Leu Ser
    355                 360                 365
Glu Thr Ala Arg Glu Pro Val Tyr His Ala Ala Gly Gly Val Asn Ser
    370                 375                 380
Tyr Arg Pro Arg Leu Asn Asn Gly Glu Asn Ile Ser Phe Ile Asp Glu
385                 390                 395                 400
Gly Lys Gly Glu Leu Ile Leu Thr Ser Asn Ile Asn Gln Gly Ala Gly
                405                 410                 415
Gly Leu Tyr Phe Gln Gly Asp Phe Thr Val Ser Pro Glu Asn Asn Glu
            420                 425                 430
Thr Trp Gln Gly Ala Gly Val His Ile Ser Glu Asp Ser Thr Val Thr
            435                 440                 445
Trp Lys Val Asn Gly Val Ala Asn Asp Arg Leu Ser Lys Ile Gly Lys
    450                 455                 460
Gly Thr Leu His Val Gln Ala Lys Gly Glu Asn Gln Gly Ser Ile Ser
465                 470                 475                 480
Val Gly Asp Gly Thr Val Ile Leu Asp Gln Gln Ala Asp Asp Lys Gly
```

```
                      485                    490                    495
Lys Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg Gly Thr
              500                    505                    510
Val Gln Leu Asn Ala Asp Asn Gln Phe Asn Pro Asp Lys Leu Tyr Phe
              515                    520                    525
Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Ser Phe
              530                    535                    540
His Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn
545                    550                    555                    560
Gln Asp Lys Glu Ser Thr Val Thr Ile Thr Gly Asn Lys Asp Ile Ala
              565                    570                    575
Thr Thr Gly Asn Asn Asn Ser Leu Asp Ser Lys Lys Glu Ile Ala Tyr
              580                    585                    590
Asn Gly Trp Phe Gly Glu Lys Asp Thr Thr Lys Thr Asn Gly Arg Leu
              595                    600                    605
Asn Leu Val Tyr Gln Pro Ala Ala Glu Asp Arg Thr Leu Leu Leu Ser
              610                    615                    620
Gly Gly Thr Asn Leu Asn Gly Asn Ile Thr Gln Thr Asn Gly Lys Leu
625                    630                    635                    640
Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Asn Asp
              645                    650                    655
His Trp Ser Gln Lys Glu Gly Ile Pro Arg Gly Glu Ile Val Trp Asp
              660                    665                    670
Asn Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys
              675                    680                    685
Gly Gly Gln Ala Val Val Ser Arg Asn Val Ala Lys Val Lys Gly Asp
              690                    695                    700
Trp His Leu Ser Asn His Ala Gln Ala Val Phe Gly Val Ala Pro His
705                    710                    715                    720
Gln Ser His Thr Ile Cys Thr Arg Ser Asp Trp Thr Gly Leu Thr Asn
              725                    730                    735
Cys Val Glu Lys Thr Ile Thr Asp Asp Lys Val Ile Ala Ser Leu Thr
              740                    745                    750
Lys Thr Asp Ile Ser Gly Asn Val Asp Leu Ala Asp His Ala His Leu
              755                    760                    765
Asn Leu Thr Gly Leu Ala Thr Leu Asn Gly Asn Leu Ser Ala Asn Gly
              770                    775                    780
Asp Thr Arg Tyr Thr Val Ser His Asn Ala Thr Gln Asn Gly Asn Leu
785                    790                    795                    800
Ser Leu Val Gly Asn Ala Gln Ala Thr Phe Asn Gln Ala Thr Leu Asn
              805                    810                    815
Gly Asn Thr Ser Ala Ser Gly Asn Ala Ser Phe Asn Leu Ser Asp His
              820                    825                    830
Ala Val Gln Asn Gly Ser Leu Thr Leu Ser Gly Asn Ala Lys Ala Asn
              835                    840                    845
Val Ser His Ser Ala Leu Asn Gly Asn Val Ser Leu Ala Asp Lys Ala
              850                    855                    860
Val Phe His Phe Glu Ser Ser Arg Phe Thr Gly Gln Ile Ser Gly Gly
865                    870                    875                    880
Lys Asp Thr Ala Leu His Leu Lys Asp Ser Glu Trp Thr Leu Pro Ser
              885                    890                    895
Gly Thr Glu Leu Gly Asn Leu Asn Leu Asp Asn Ala Thr Ile Thr Leu
              900                    905                    910
Asn Ser Ala Tyr Arg His Asp Ala Ala Gly Ala Gln Thr Gly Ser Ala
              915                    920                    925
```

```
Thr Asp Ala Pro Arg Arg Arg Ser Arg Arg Ser Arg Arg Ser Leu Leu
    930              935              940
Ser Val Thr Pro Pro Thr Ser Val Glu Ser Arg Phe Asn Thr Leu Thr
945              950              955              960
Val Asn Gly Lys Leu Asn Gly Gln Gly Thr Phe Arg Phe Met Ser Glu
             965              970              975
Leu Phe Gly Tyr Arg Ser Asp Lys Leu Lys Leu Ala Glu Ser Ser Glu
             980              985              990
Gly Thr Tyr Thr Leu Ala Val Asn Asn Thr Gly Asn Glu Pro Ala Ser
             995              1000             1005
Leu Glu Gln Leu Thr Val Val Glu Gly Lys Asp Asn Lys Pro Leu Ser
    1010             1015             1020
Glu Asn Phe Asn Phe Thr Leu Gln Asn Glu His Val Asp Ala Gly Ala
1025             1030             1035             1040
Trp Arg Tyr Gln Leu Ile Arg Lys Asp Gly Glu Phe Arg Leu His Asn
             1045             1050             1055
Pro Val Lys Glu Gln Glu Leu Ser Asp Lys Leu Gly Lys Ala Glu Ala
             1060             1065             1070
Lys Lys Gln Ala Glu Lys Asp Asn Ala Gln Ser Leu Asp Ala Leu Ile
             1075             1080             1085
Ala Ala Gly Arg Asp Ala Val Glu Lys Thr Glu Ser Val Ala Glu Pro
    1090             1095             1100
Ala Arg Gln Ala Gly Gly Glu Asn Val Gly Ile Met Gln Ala Glu Glu
1105             1110             1115             1120
Glu Lys Lys Arg Val Gln Ala Asp Lys Asp Thr Ala Leu Ala Lys Gln
             1125             1130             1135
Arg Glu Ala Glu Thr Arg Pro Ala Thr Thr Ala Phe Pro Arg Ala Arg
             1140             1145             1150
Arg Ala Arg Arg Asp Leu Pro Gln Leu Gln Pro Gln Pro Gln Pro Gln
             1155             1160             1165
Pro Gln Arg Asp Leu Ile Ser Arg Tyr Ala Asn Ser Gly Leu Ser Glu
    1170             1175             1180
Phe Ser Ala Thr Leu Asn Ser Val Phe Ala Val Gln Asp Glu Leu Asp
1185             1190             1195             1200
Arg Val Phe Ala Glu Glu Arg Arg Asn Ala Val Trp Thr Ser Gly Ile
             1205             1210             1215
Arg Asp Thr Lys His Tyr Arg Ser Gln Asp Phe Arg Ala Tyr Arg Gln
             1220             1225             1230
Gln Thr Asp Leu Arg Gln Ile Gly Met Gln Lys Asn Leu Gly Ser Gly
             1235             1240             1245
Arg Val Gly Ile Leu Phe Ser His Asn Arg Thr Glu Asn Thr Phe Asp
    1250             1255             1260
Asp Gly Ile Gly Asn Ser Ala Arg Leu Ala His Gly Ala Val Phe Gly
1265             1270             1275             1280
Gln Tyr Gly Ile Asp Arg Phe Tyr Ile Gly Ile Ser Ala Gly Ala Gly
             1285             1290             1295
Phe Ser Ser Gly Ser Leu Ser Asp Gly Ile Gly Gly Lys Ile Arg Arg
             1300             1305             1310
Arg Val Leu His Tyr Gly Ile Gln Ala Arg Tyr Arg Ala Gly Phe Gly
             1315             1320             1325
Gly Phe Gly Ile Glu Pro His Ile Gly Ala Thr Arg Tyr Phe Val Gln
             1330             1335             1340
Lys Ala Asp Tyr Arg Tyr Glu Asn Val Asn Ile Ala Thr Pro Gly Leu
1345             1350             1355             1360
Ala Phe Asn Arg Tyr Arg Ala Gly Ile Lys Ala Asp Tyr Ser Phe Lys
```

```
                1365              1370              1375
Pro Ala Gln His Ile Ser Ile Thr Pro Tyr Leu Ser Leu Ser Tyr Thr
            1380              1385              1390
Asp Ala Ala Ser Gly Lys Val Arg Thr Arg Val Asn Thr Ala Val Leu
        1395              1400              1405
Ala Gln Asp Phe Gly Lys Thr Arg Ser Ala Glu Trp Gly Val Asn Ala
    1410              1415              1420
Glu Ile Lys Gly Phe Thr Leu Ser Leu His Ala Ala Ala Ala Lys Gly
1425              1430              1435              1440
Pro Gln Leu Glu Ala Gln His Ser Ala Gly Ile Lys Leu Gly Tyr Arg
                1445              1450              1455
Trp
```

<210> 5
<211> 34
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 5
ggggctagc aaaacaaccg acaaacggac aacc   34

<210> 6
<211> 40
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 6
ggggaagctt ccagcggtag cggtagccta atttgatgcc   40